An Experimental System for Comparing Speed, Accuracy, and Completeness of Physician Data Entry using Electronic and Paper Methods

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Electronic medical record (EMR) systems have important potential advantages over traditional paper-based systems, but they require that physicians assume responsibility for data entry. However, little is known about the quality of physician data entry in electronic systems. This study describes a system for comparing the speed, accuracy, and completeness of examination data entry using electronic and paper methods. Data will be shown to demonstrate that this may be a simple, reproducible, and useful technique.

Motivation

In most existing EMR systems, physicians must assume the responsibility for medical data entry with user interface widgets such as pull-down menus, checkboxes, and text boxes. Physician resistance to this new responsibility has long been cited as a major barrier to the implementation of EMR systems [1].

There is relatively little published literature that addresses how the speed, accuracy, and completeness of medical data entry into EMRs compare to that of traditional paper entry [2]. For example, many existing systems use examination templates with pre-defined sets of positive and negative findings, which may encourage over-coding. These factors are likely to significantly influence the acceptance and efficacy of EMRs, although end-users are often unaware of these issues before purchasing new systems [3]. This study addresses these gaps in knowledge by describing a method that allows for direct comparison of paper and electronic data entry methods by measuring the speed, recall, and precision of physical examination findings from hypothetical patient case scenarios.

Test Environment

A prototype EMR was used for this study, based on an actual outpatient system that is being implemented at Columbia-Presbyterian Medical Center (Epic Systems, Madison, WI). Physicians enter progress notes into this system, using a text-based interface. Examination templates are supplied with the system, and may be modified by local system administrators.

Experimental System

The institute-wide data repository at the Columbia-Presbyterian Medical Center was searched to identify the most common diagnoses, from which problems were selected such that each major body system was represented at least once. Hypothetical case scenarios, consisting of a history and physical examination, were constructed for these problems by an independent physician who had no knowledge of the EMR system interface. Case scenarios were presented to subjects orally, and subjects are asked to enter findings using paper and EMR methods.

Each case scenario and subject's response was parsed into discrete positive or negative findings. Subject responses were then compared to the original case scenario. Each discrete finding in the case scenario was classified as a "true positive," meaning that is was also present in the subject's response; or a "false negative," meaning that it was not present in the subject's response. Each discrete finding in the subject's response was classified as either a "true positive," meaning that it was present in the actual case presentation; a "false positive," meaning that it was not present in the actual case presentation; or a "likely true positive," meaning that it was not explicitly mentioned in the case presentation but could have reasonably been detected from the information presented. Based on this information, the speed, recall, and precision of paper and electronic data entry methods were determined. This is a simple and reproducible method of comparing physician data entry using paper and electronic methods (reliability coefficients using three judges for speed, recall, and precision were 0.938, 0.867, and 0.813, respectively). Data will be presented to show that this method can elicit important differences in physician data capture using paper and EMR methods, such as differing rates of under- and over-coding of examination findings.

References

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